

Engineer Kēpa Morgan

NZASE
scientist
profile

Born

Waipawa, Hawke's Bay on Mothers' Day, 1963.

Affiliations

Kēpa affiliates to Ngāti Pikiao of Te Arawa, Ngāti Kahungūnu, Rongomaiwahine, and Ngāi Tahu.

Schools and subjects

Kēpa went to Whangarei Boys' High School, where he studied Chemistry, Physics, applied and pure Maths.

How he got into science

Kēpa says he originally got into Science because "I wasn't great at other subjects, but I was pretty good at 8-ball and cards. Angles and maths are important in engineering." He says he's also driven to find solutions in a range of areas for problems that Māori face.

Training and jobs

1985, BE (Civil), University of Auckland
1987-93, Engineer, Hamilton City Council
1993-98, Operations Manager, Te Rūnanga o Ngāti Pikiao
1997, Graduate Diploma in Management;
1999, MBA in Tech, both at Deakin University.
2008, PhD in Civil Engineering, University of Auckland
2000-2017 Senior Lecturer, Civil and Environmental Engineering, University of Auckland;
Associate Dean Māori 2002-2010
2017 - now, Pou Hautū, Mahi Maioro Professionals.

Kēpa Morgan stands to tautoko a response to Ngāi Tūāhuriri o Ngāi Tahu during the pōwhiri of the Water NZ Conference and Expo 2022.

Science fields

Structural and civil engineering, mātauranga Māori, impact assessment, systems thinking.

Research examples

Aashukan Declaration

In 2017, in the traditional territory of the James Bay Cree in Quebec, as co-chair of the Indigenous Peoples' Section, Kēpa helped draft the *Aashukan Declaration* about environmental Impact Assessment. The declaration's principles for best-practice impact assessment were adopted at the International Association of Impact Assessment annual meeting in Montreal, Canada, in 2017.

Kēpa stands in front of an Ice Road truck operated by the James Bay Cree. Kepa means "can do" in the Cree language.



NZASE

New Zealand Association of Science Educators

Representing the needs of science teachers

Whare uku

In 1996, with increasing building costs, Kē pa looked for high-quality building alternatives to wood, especially for Māori wanting to move back to communal land. “Rammed earth is brittle, like a biscuit; our goal was to make it safe to be inside an earth building on shaky ground.



A whare uku being finished in Te Tai Tokerau. Photo: Te Ahikaaroa Trust.

“It needed to be ductile – able to bend like a banana, so it deforms and absorbs energy without breaking. We had to add something to make rammed earth ductile, so we looked to mātauranga Māori and added muka – it’s more forgiving than fibreglass and steel, which are too strong in tension to be compatible with the compression strength of earth.

“The two layers of muka are separated by a harder layer similar to the outside layers; you can’t just take the outside layers off. We developed a threshing machine powered by a lawnmower engine, similar to the huge old flax mills, but we made it small to go on a trailer. It spins fast; you feed in the flax and it removes all hard material leaving the muka. Then it’s dried and cut into lengths, ~55 mm.

“Fibre reinforcement doesn’t provide a continuous transfer of load, it just stops cracks from spreading. Fibre-glass works like that, it hangs together because cracks don’t spread.

“Electricians and plumbers aren’t familiar with whare uku, so they see the material as a problem. Whare uku have huge potential, and they’re starting to take off. We’ve developed a hybrid solution, with a portable, self-contained kitchen, laundry, bathroom and toilet unit, plumbed and wired with solar panels, which can be connected to a rammed earth

wharemoae (sleeping house) or a re-purposed state house.”

Restoring mauri after Rena

The container and cargo ship MV *Rena* grounded on Ōtāiti (Astrolabe Reef) off Tau-ranga in 2011, spilling a cargo of heavy fuel oil, marine diesel and 1,300 containers, creating the country’s worst environmental maritime disaster. Ōtāiti is an important fishing ground and a gateway to the gods for hapū linked to Te Arawa waka.

“The government’s goal was to restore the mauri (life force) of Ōtāiti to its pre-disaster state,” says Kēpa. “At that time, no one knew how to determine the mauri state of anything, and there was little data about what the reef was like before the disaster.” Local hapū Te Arawa ki Tai worked with him to compile performance indicators to assess impacts on mauri.

“We used mātauranga Māori to determine its original mauri state with incomplete information. We had to assess that and work how to restore it while it continued to change.

“They delayed moving the ship, created a bigger and bigger problem.” With the *Rena* disintegrating on the reef, the mauri model provided the means to monitor the cumulative impact the disaster was having on the environment.

“The assessment twice prevented the company from leaving the disaster site in a very poor state, after other consultants advised that they could get ready to leave. The mauri analysis doesn’t determine the outcome, but it quantified the likely consequences of different actions”

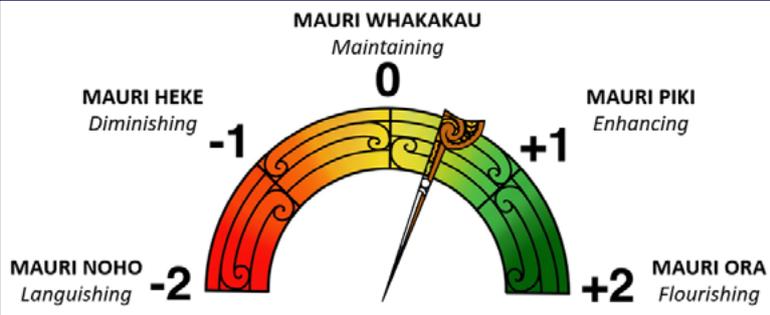
Rena containers and debris on the beach south of Mount Maunganui. Photo: Maritime NZ.



NZASE

New Zealand Association of Science Educators

Representing the needs of science teachers



How he finds things out

Kēpa works with communities to change environmental issues that affect them, and feeds back new information and results to those communities, a process called participatory action research. He gathers environmental data about water quality, soil health, or biodiversity, and designs experiments to test solutions.

Most valuable results

Evaluations using the mauri0meter

Since the *Rena* disaster, the mauri0meter (above) has been used in Aotearoa and overseas to assess the impacts of climate change; contaminated sites; marine ecosystems; historical changes; dams, roads, bridges, sewerage and other infrastructure projects; Māori land developments; and to analyse catchments in water development projects.

“The blade of the tewhatewha (staff with a flat section at one end) represents the mauri trend, signalling whether the mauri state is diminishing or enhancing based on comparison with a prior mauri state.”

An example is a live tool that combines cultural monitoring data (collected by Ngāti Tahu-Ngāti Whaoa using their own dedicated app) with live environmental sensors to track changes to mauri within their rohe accurately and quickly.

Kēpa has regularly been an expert witness for iwi and hapū in Environmental Court hearings. The mauri0meter’s four dimensions – Mauri of ecosystem; hapū and iwi; community; and whānau – match the four wellbeing indicators of the Resource Management Act.

Kēpa makes the mauri0meter publicly available online, with case studies and answers to common questions, and welcomes its use by students and teachers.

“The concepts and the scoring process are intuitive – most children understand them easily.” He plans to develop a school resource, with a former teacher joining the staff of his

consultancy, Mahi Maioro Professionals. University academics and other Māori scientists regularly use the tool in their teaching.

Mātauranga Māori

Mauri-based assessment and the mauri0meter are derived from mātauranga Māori. “Starting with a mauri-based understanding allows you to better understand the scientific data. For example, measures of nitrates in water over time can tell you the trend, but can’t tell you if it’s any good. The Mauri scale is pretty absolute, with coarse numbering; you can be fairly confident of an aggregate understanding that’s meaningful.

“Science has been a tool of colonisation, empowering the colonisation agenda. Equity, justice and power imbalances were separated from scientific inquiry during its development in the 1600s. And while universities now have ethics committees and processes, there is still work to do in addressing aspects of science’s origins.”

What he likes about science

“I like that most recently Science is becoming more open to alternative ways of knowing, such as mātauranga Māori.”

Links

Science Learning Hub, 2016, [Restoring mauri after the Rena disaster](#) (article + 26m video).

[Mauri0Meter](#) (website).

[Te mauri o te awa o Waiāri](#), Tapuika group.

Kēpa Morgan, 2015, [Mission Impossible? Returning the Mauri of the ecosystem to its pre-Rena state](#), Ngā Pae o te Māramatanga (59m video).

Kēpa Morgan, 2015, [To survive, we must measure our actions not by money, but Mauri](#) (14m video).

Ngā Kupu

Hapori – Community, society

Humi – Abundant

Moe – Exhausted, dead, sleep

Ngahue – Abundance

Noho – Languishing

Ora – Flourishing, wellbeing

Tewhatewha – Long weapon with a flat section at one end

Whakakau – To come gradually into view.

From Te Aka Māori Dictionary



NZASE

New Zealand Association of Science Educators

Representing the needs of science teachers